APPENDIX J
SOIL EROSION CALCULATIONS

Assumptions and Background for Calculations

While long-term wind and water caused soil erosion rates are predicted to be low in areas with established permanent cover and hardened surfaces (graveled pads, roads, etc.), potentially moderate erosion losses may occur on unimproved roads, other bare areas, and during short-term construction practices. If not protected, the majority of soils found on RBTI have the potential for water and wind erosion. However, best management practices would be followed and the erosion potential would be minimal. The following describes how soil erosion is calculated and Table J-1 provides the data that were used for these calculations.

Excessive water runoff causes three types of erosion: sheet, rill, and gully. The Universal Soil Loss Equation (USLE) can be used to estimate loss rates due to sheet and rill erosion. Gully erosion is more apparent when it occurs and is calculated by direct volume measurements. It is difficult to predict gully erosion rates: it is based on site specific factors and professional judgment.

Wind-caused erosion is typically most severe where soil textures are sandy. Moisture helps bind soil particles together, therefore, this type of erosion occurs predominantly during dry periods. Fine textured soils are susceptible to wind erosion if pulverized, as on road surfaces. Airborne dust, or fugitive dust, can be a result of this type of erosion.

USLE factors used to calculate sheet and rill erosion rates were obtained from various USDA-NRCS (SCS) soil surveys, NRCS technical guides, and NRCS soil scientists from New Mexico and Texas. Gully erosion estimates were based on site specific data provided by qualified field crew and technical staff after review of proposed construction concepts. Gully erosion may be a factor on localized sites and should be added to overall loss calculations. If it is known to occur, gully erosion can be estimated using an average gully size (e.g., v-shaped gully 30 ft. long by 2 ft. wide at ground surface by 1 ft. deep = 30 ft.^{3} = 1.1 yd.^{3}, which is about 1 ton of soil).

Wind erosion estimates are based on NRCS methodologies (Wind Erosion Equation or WEQ), as well as an EPA standard method for calculating losses due to construction practices, in the form of fugitive dust (1.2 tons/ac/month x 50% reduction factor with Best Management Practice use = 0.6 tons/ac/month). Because some factors are site specific, WEQ calculations were made for each candidate MTR and MOA emitter and electronic scoring site. A 70% overall reduction factor that recognizes application of Best Management Practices is used in this analysis for WEQ. Care must be used when generalizing about wind erosion (see Assumptions).

Formulas, factors, and assumptions used in all cases are listed below.

Summary

1. Calculate area (acres) of ground to be disturbed (roads and right-of-ways, building pad areas, etc.), according to soil types listed for each emitter/scoring site.
2. Total predicted soil lost for given site = (acres x USLE factors) + (acres x Wind Erosion factors) + gully losses if any.

Assumptions

1. Total disturbed area for MTR/MOA sites = 0.6 acres.
2. Total disturbed area for ESS sites = 3.3 acres.
3. Bare soil construction period at each site is 10 days (0.33 months).
4. Erosion will be negligible after construction period is completed.
5. 250 lbs./ac. vegetation cover and/or coarse fragments, and no soil clods or crusts in construction areas (pulverized soil conditions).
6. Moderate to high erosion factors are used in USLE calculations (*P* factor equals *1*, *C* factor adjusted for low cover with low management =0.50, slope length *L* maximum and gradient *S* low, all other factors per NRCS FOTGs).
7. Wind erosion loss as fugitive dust will be reduced by 50% with application of Best Management Practices such as watering and soil stockpiling.
8. Other wind erosion losses to saltation, suspension, and surface creep, as calculated by WEQ will be reduced by 70% with application of Best Management Practices such as watering, covering with erosion fabric, and soil stockpiling.
9. Moderate to high erosion factors are used in Wind Erosion Equation (*K* factor set to 1, *L* factor at maximum length for graded site, *V* factor set low converted to small grain equivalents, all other factors per NRCS FOTGs).
10. Wind erosion calculated on 12-month basis and reduced to 10-day period. Because wind erosion periods vary on monthly basis, actual erosion rates will depend on weather conditions during construction periods.
11. Gully erosion will be minimal except on margins of steepest sites.

Factors and Calculations

(Note: Factors used in the USLE are not the same as in the Wind Erosion Equation)
BMP = Best Management Practice
USLE: $R \times K \times LS \times C \times P = A$ in *tons/ac/year*

Wind Erosion Equation: $f\,(I\ K\ C\ L\ V) = E \times BMP$ *reduction factor* $= E_{Tot}$ in *tons/ac/year*.

Fugitive Dust: 1.2 tons/ac/month x BMP reduction factor = D in *tons/ac/month*

Table J-1. Soil Erosion Calculations for Candidate Emitter and Electronic Scoring Sites

						Sheet and Rill Erosion						*Wind Erosion*							*Fugitive Dust*							*Gully Erosion**		*TOTAL***
Alt.	*Site Number*	*Soil Survey Area*	*Site Type*	*Soil Map Unit*	*Slope (%)*	R	K	LS	C	P	A tons/ac/ year	I	K	C	L	V	E tons/ac/ year	E_{Tot} (w 70% BMP Reduc.)	Tons	BMP % Reduc.	D tons/ac/ month	$[(A + E_{Tot})$ / 12 + D] x 0.33 months	x	Total Acres	+	(Cu. Ft. lost/ 27 ft³/ ton)	=	Tons Erosion per Site
B	64	Scurry	MOA Emitter	Mansker series, Olton series	1-3 (est.)	120	0.32	0.27	0.50	1.0	5.18	86	1	55	100	250	12.1	3.6	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.3
B	65	Borden	MOA Emitter	Patricia fine sandy loam	1-3	120	0.38	0.27	0.50	1.0	6.16	86	1	65	100	250	16.2	4.9	1.2	50%	0.6	0.5	x	0.6	+	0	=	0.3
B	66	Borden	MOA Emitter	Lofton clay loam	0.2-0.6	120	0.32	0.13	0.50	1.0	2.50	86	1	65	100	250	16.2	4.9	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.2
B	67	Borden	MOA Emitter	Spade-Latom Complex	2-5	120	0.24	0.29	0.50	1.0	4.18	86	1	65	100	250	16.2	4.9	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.3
B	72	Garza	MOA Emitter	Berda loam	1-3	130	0.28	0.27	0.50	1.0	4.91	86	1	65	100	250	16.2	4.9	1.2	50%	0.6	0.5	x	0.6	+	0	=	0.3
B	95	Scurry	MOA Emitter	Miles and Cobb fine sandy loam	1-3	120	0.24	0.27	0.50	1.0	3.89	86	1	55	100	250	12.1	3.6	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.2
B/C	54	Brewster	MTR Emitter	Badland-Vieja Association	3-15	80	0.43	0.29	0.50	1.0	4.99	1	1	120	100	250	0.4	0.1	1.2	50%	0.6	0.3	x	0.6	+	0	=	0.2
B/C	55	Presidio	MTR Emitter	Nickel-Canutio Association (est.)	0-3	70	0.15	0.13	0.50	1.0	0.68	1	1	120	100	250	0.4	0.1	1.2	50%	0.6	0.2	x	0.6	+	0	=	0.1
B/C	59	Reeves	MTR Elect. Scor. Site	Delnorte-Nickel Association	5-12	80	0.15	0.35	0.50	1.0	2.10	1	1	120	300	250	1.3	0.4	1.2	50%	0.6	0.3	x	3.3	+	0	=	0.9
B/C	60	Reeves	MTR Elect. Scor. Site	Hodgins silty clay loam	0-1	80	0.32	0.18	0.50	1.0	2.30	86	1	120	300	250	62.6	18.8	1.2	50%	0.6	0.8	x	3.3	+	0	=	2.6
B/C	81	Brewster	MTR Emitter	Reagan-Hodgins-Sanderson Association	1-15 (est.)	80	0.37	0.29	0.50	1.0	4.29	1	1	120	100	250	0.4	0.1	1.2	50%	0.6	0.3	x	0.6	+	1	=	1.2
B/C	82	Pecos	MTR Emitter	Reagan silty clay loam, saline	0-1	90	0.32	0.13	0.50	1.0	1.87	1	1	120	100	250	0.4	0.1	1.2	50%	0.6	0.3	x	0.6	+	0	=	0.2
B/C	91	Pecos	MTR Emitter	Ector-Rock Outcrop Association, steep	20-45	90	0.15	0.43	0.50	1.0	2.90	1	1	120	100	250	0.4	0.1	1.2	50%	0.6	0.3	x	0.6	+	0	=	0.2
B/C	93	Pecos	MTR Emitter	Ector Association, hilly	10-30	90	0.1	0.35	0.50	1.0	1.58	1	1	120	100	250	0.4	0.1	1.2	50%	0.6	0.2	x	0.6	+	0	=	0.1
C	78	Upton	MOA Emitter	Reagan silty clay loam, saline	0-1	120	0.37	0.13	0.50	1.0	2.89	1	1	80	100	250	0.3	0.1	1.2	50%	0.6	0.3	x	0.6	+	0	=	0.2
C	79	Schleicher	MOA Emitter	Ector Association	1-8	150	0.1	0.29	0.50	1.0	2.18	1	1	50	100	250	0.3	0.1	1.2	50%	0.6	0.3	x	0.6	+	0	=	0.2
C	80	Upton	MOA Emitter	Ector very gravelly loam	1-8	120	0.1	0.29	0.50	1.0	1.74	1	1	80	100	250	0.3	0.1	1.2	50%	0.6	0.2	x	0.6	+	1	=	1.1
C	88	Regan	MOA Emitter	Conger-Reagan Association	0-3	120	0.37	0.13	0.50	1.0	2.89	86	1	70	100	250	20.3	6.1	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.3
C	89	Regan	MOA Emitter	Conger-Reagan Association	0-3	120	0.37	0.13	0.50	1.0	2.89	86	1	70	100	250	20.3	6.1	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.3
C	94	Irion	MOA Emitter	Ector very gravelly loam undulating	1-8	130	0.1	0.27	0.50	1.0	1.76	1	1	60	100	250	16.2	4.9	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.2
C/B/D	61	Taylor	En Route Elect. Scor. Site	Vernon Clay	1-3	170	0.32	0.29	0.50	1.0	7.89	86	1	35	300	250	5.1	1.5	1.2	50%	0.6	0.5	x	3.3	+	0	=	1.5
C/B/D	62	Taylor	En Route Elect. Scor. Site	Tillman clay loam	1-3	170	0.32	0.29	0.50	1.0	7.89	48	1	35	300	250	1.2	0.4	1.2	50%	0.6	0.4	x	3.3	+	0	=	1.4
D	2	Guadalupe	MTR Emitter	Clovis-Pastura Association	0-3	120	0.22	0.13	0.50	1.0	1.74	86	1	80	100	250	24.8	7.4	1.2	50%	0.6	0.5	x	0.6	+	0	=	0.3
D	6	Guadalupe	MTR Emitter	Tucumcari-Redona Association	0-5	120	0.37	0.29	0.50	1.0	6.44	86	1	80	100	250	24.8	7.4	1.2	50%	0.6	0.6	x	0.6	+	0	=	0.3
D	7	Guadalupe	MTR Emitter	La Lande-Chispa Complex	3-15	120	0.28	0.29	0.50	1.0	4.87	56	1	80	100	250	11.1	3.3	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.3
D	14	Harding	MOA Emitter	Dumas loam	0-3	120	0.32	0.13	0.50	1.0	2.50	56	1	100	100	250	16.1	4.8	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.2
D	15	Colfax	MOA Emitter	Dioxice fine sandy loam	1-5	120	0.28	0.27	0.50	1.0	4.54	86	1	90	100	250	29.3	8.8	1.2	50%	0.6	0.6	x	0.6	+	0	=	0.3
D	16	Colfax	MOA Emitter	Gruver fine sandy loam	0-3	120	0.28	0.13	0.50	1.0	2.18	48	1	90	100	250	9.7	2.9	1.2	50%	0.6	0.3	x	0.6	+	0	=	0.2
D	17	Union	MOA Emitter	Colmor silty clay loam	0-5	120	0.37	0.29	0.50	1.0	6.44	86	1	120	100	250	44.3	13.3	1.2	50%	0.6	0.7	x	0.6	+	0	=	0.4
D	20	Union	MOA Emitter	Torreon silty clay loam	0-3	120	0.37	0.13	0.50	1.0	2.89	48	1	120	100	250	15.6	4.7	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.2
D	21	Union	MOA Emitter	Spurlock loam	1-5	120	0.28	0.27	0.50	1.0	4.54	86	1	120	100	250	44.3	13.3	1.2	50%	0.6	0.7	x	0.6	+	0	=	0.4
D	24	Guadalupe	MTR Emitter	Clovis-Pastura Association	0-3	120	0.28	0.13	0.50	1.0	2.18	86	1	80	100	250	24.8	7.4	1.2	50%	0.6	0.5	x	0.6	+	0	=	0.3
D	28	Harding	MTR Elect. Scor. Site	Dioxice loam	0-3	120	0.37	0.27	0.50	1.0	5.99	86	1	100	300	250	49.6	14.9	1.2	50%	0.6	0.8	x	3.3	+	0	=	2.5
D	33	Union	MTR Elect. Scor. Site	Spurlock-Plack Complex	0-9	120	0.32	0.29	0.50	1.0	5.57	86	1	120	300	250	44.3	13.3	1.2	50%	0.6	0.7	x	3.3	+	0	=	2.4
D	34	Tucumcari Area (N. Quay Co.)	MTR Elect. Scor. Site	Amarillo fine sandy loam, Amarillo loamy fine sand	0-3	120	0.24	0.29	0.50	1.0	4.18	134	1	120	300	250	117.2	35.2	1.2	50%	0.6	1.3	x	3.3	+	0	=	4.2
D	35	Harding	MOA Emitter	Tricon loam	0-3	120	0.43	0.13	0.50	1.0	3.35	48	1	100	100	250	11.3	3.4	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.2
D	36	Harding	MOA Emitter	Dioxice loam	0-3	120	0.37	0.13	0.50	1.0	2.89	86	1	100	100	250	49.6	14.9	1.2	50%	0.6	0.7	x	0.6	+	0	=	0.4
D	37	Guadalupe	MTR Emitter	Pastura-Clovis Associaton	0-8	120	0.28	0.29	0.50	1.0	4.87	86	1	80	100	250	24.8	7.4	1.2	50%	0.6	0.5	x	0.6	+	0	=	0.3
D	38	Guadalupe	MTR Emitter	Redona-Hilken Loams	0-2	120	0.55	0.2	0.50	1.0	6.60	56	1	80	100	250	11.1	3.3	1.2	50%	0.6	0.5	x	0.6	+	0	=	0.3
D	39	Guadalupe	MTR Emitter	San Jon-Latom Rock Outcrop Complex	1-10	120	0.37	0.29	0.50	1.0	6.44	86	1	80	100	250	24.8	7.4	1.2	50%	0.6	0.6	x	0.6	+	0	=	0.3
D	40	Mora	MTR Emitter	Mion-Penrose Varient-Rock Outcrop Complex	3-45	120	0.15	0.29	0.50	1.0	2.61	48	1	80	100	250	8.0	2.4	1.2	50%	0.6	0.3	x	0.6	+	0	=	0.2
D	41	Mora	MTR Emitter	Partri loam	1-3	120	0.37	0.27	0.50	1.0	5.99	48	1	80	100	250	8.0	2.4	1.2	50%	0.6	0.4	x	0.6	+	0	=	0.3

** Little evidence that gully erosion may occur on site was observed.*

*** Short-term erosion rates. Actual rates will depend on weather factors during construction period. Long-term erosion is not expected to exceed natural back-ground rates. Sites are relatively level and will be paved with rock or asphalt.*